The World From a Different Perspective

Geography From the International Space Station

Written and Developed by Futron Corporation
for
NASA Space and Life Sciences
at
Lyndon B. Johnson Space Center

Table of Contents

Introduction	3
Longitude and Latitude	4
Objectives	
National Standards	
Materials Needed	
Background information	
Mapping it Out Activity	5
Just Grin and Grid It Activity	6
You Found My Location Activity	6
List 1	7
List 2	8
Location is Everything Activity	9
Location Descriptions	10-11
Discussion, Extensions, Assessment	11
Topography	12
Activity Directions	15
Geography Definitions Student Sheet	14-15
Geography Definitions Key	16-17
Geography Examples Student Sheet	18-19
Geography Examples Key	20
Photo Match Activity	21-22
Photo Match Key	24
Extensions, Assessment	25

There are hundred of thousands of Earth observation images such as those pictured here. There photographs are a valuable scientific and educational resource.

San Francisco Bay
STS 58
October 1993

Alexandria, Egypt
STS 36
March 1990

Introduction

The International Space Station (ISS) will be the largest orbiting spacecraft in history. The space agencies of the United States, Russia, Japan, Europe, and Canada are working together to build what can only be called "A New Star on the Horizon." Worldwide research in biology, chemistry, physics, and other sciences will be conducted in the International Space Station's six laboratories. The assembly of the ISS will open the door to future long-duration human exploration of the solar system, as well as provide continuous benefits to science, industry, and medicine on Earth. Another area of interest to scientists is the Earth itself. There is no doubt that the best view of the Earth is from space. It allows for global vision. The Space Shuttle has long been a window to the Earth. Fabulous pictures, or Earth observations, have been taken over the years allowing us a window for weather forecasts, the health of sea life, and the affects of global warming. But the Shuttle is only in space for short periods of time a few times a year. The ISS will give scientists a year-round view of our planet.

Earth observations give a unique introduction to Earth science disciplines -- geography, geology, oceanography, ecology, and meteorology. High quality photographic equipment and large quantities of film capture Earth observations for further analysis and interpretation. Scientists at the Johnson Space Center prepare a set of sites for crewmembers to observe and photograph. These sites are based on requests from scientists around the world. Daily updates of events such as volcanic eruptions, hurricanes, and weather conditions are given so that the crew may photograph these phenomena.

Latitude and Longitude

Objective:
Students will be able to demonstrate an understanding of the concepts of relative location using simple directions, and absolute location using latitude and longitude.

National Standards:
· Geography
The World in Spatial Terms: Analyze the spatial organization of people, places, and environments on the Earth's surface.
· Mathematics
Mathematical Connections: Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.
Number Systems and Number Theory: Understand and appreciate the need for numbers beyond the whole numbers and develop and use order relations for numbers.

Measurement: Understand the structure and use of systems of measurement.

Materials Needed:
Student sheets
Atlas for each student

Background
As an educator plans a geography unit, he or she usually uses location as the primary lesson because it is the easiest and most understandable objective to teach. Even small children learn the location of their favorite places. They know where their school is and how to get home. They may not know the address, but they recognize landmarks and can tell which way to turn in order to get there. Every day people ask for directions to get to a certain location. Those questions can be answered by givingdirections in terms of landmarks (turn left at the red barn) or using measurements of distance and compass directions (go north for 3 miles and turn east).

There are two types of location. Relative location gives us a general description in terms if its relationship to something else. For example: California is on the west coast of the United States. It is on the Pacific Ocean. Absolute location gives specific directions, using latitude and longitude. Albany, the capital of New York, is located at 42.7°N, 73.8°W. Absolute location is used in map reading. Many people, from pilots and ship captains, to satellite programmers use absolute location for directions. It is a precise form of measurement.

Activity #1 Mapping It Out

Step1. Line up either the students' desks or the students themselves into rows forming a grid.
Step 2. Designate front of the classroom as north.
Step 3. Have the students identify north, south, east, and west by locating other students in terms of compass directions in relation to themselves.
Step 4. We will call the lines of students which extend from one side of the classroom to ther other "rows" and the lines of students which extend from the front of the classroom to the back as "columns." The "row" containing the middle student is 0° E/W.
Step 5. Extending from the middle student, label the rows by tens of degrees of latitude and the columns by tens of degrees of longitude, until all the rows and columns are labeled. Now, if you are a student facing the front of the room, the column to your right is 10° farther east than your column. To make this concept more concrete, label each studen's posostion, using a sheet of paper on the floor with the designated latitude and longitude.

Front of classroom (N)

20° N, 20° W	20° N, 10° W	20° N, 0° E/W	20° N, 10° E	20° N, 20° E
10° N, 20° W	10° N, 10° W	10° N, 0° E/W	10° N, 10° E	10° N, 20° E
0° N/S, 20° W	0° N/S, 10° W	0° N/S, 0° E/W	0° N/S, 10° E	0° N/S, 20° E
10° S, 20° W	10° S, 10° W	10° S, 0° E/W	10° S, 10° E	10° S, 20° E
20° S, 20° W	20° S, 10° W	20° S, 0° E/W	20° S, 10° E	20° S, 20° E
30° S, 20° W	30° S, 10° W	30° S, 0° E/W	30° S, 10° E	30° S, 20° E

Back of classroom

Above is an example of a classroom of 30 students.

Activity #2

Just Grin and Grid It

The following activity gives the students practice with the concepts of latitude and longitude.

Step1. Make a 3 x 5 card for each latitude /longitude position in the grid. From this “deck” of cards, each student will select the card which shows where he or she isitting in the grid. They should keep the card face down so the other students do not see it.
Step 2. Choose students at random to identify, by latitude and longitude, the locations of other students. The class should vote on whether that identification is correct. Then the student will show his/her true location by revealing the coordinates on the card.
Step 3. Give each student a sealed envelope with an exact location iinside.

The student should then find that location in the grid.

Activity #3

You Found My Location!

This activity allows students to explore reading latitude and longitude on atlas maps.
Students will use latitude and latitude to identify locations in an atlas.

Step1. Divide the students into pairs.
Step 2. Each student will receive a list of locations, and each pair of students will be given an atlas.
Step 3. One student reads out a location in latitude and longitude and the other student finds the location in the atlas and gives the correct location.
Step 4. The pair of students alternate with each other giving and finding of locations until the list is complete.
Step 5. When the lists are complete, have the students find 10 new locations and their latitudes and longitudes. These will be written down and exchanged with the other students.

You Found My Location! (List 1)

Read a latitude and longitude to your partner. Your partner will look in the atlas and give a location. Check the answers to see if they are correct.

Read to partner	Answer
1. 22°S, 42°W	Rio de Janeiro, Brazil
2. 30°N, 31°E	Cairo, Egypt
3. 35°N, 139°E	Tokyo, Japan
4. 55°N, 37°E	Moscow, Russia
5. 48°N, 2°E	Paris, France
6. 51°N, 0°W	London, England
7. 14°N, 121°E	Manila, Philippines
8. 33°S, 151°E	Sydney, Australia
9. 8°S, 115°E	Bali, Indonesia
10. 19°N, 155°W	Hawaii

Latitudes and longitudes are given in degrees only. These are not actual figures. For instance, Las Vegas is actually 36 degrees 12 minutes north, 115 degrees 13 minutes west.

You Found My Location! (List 2)

Read a latitudes and longitudes to your partner. They will look in the atlas and give a location. Check the answers to see if they are correct.

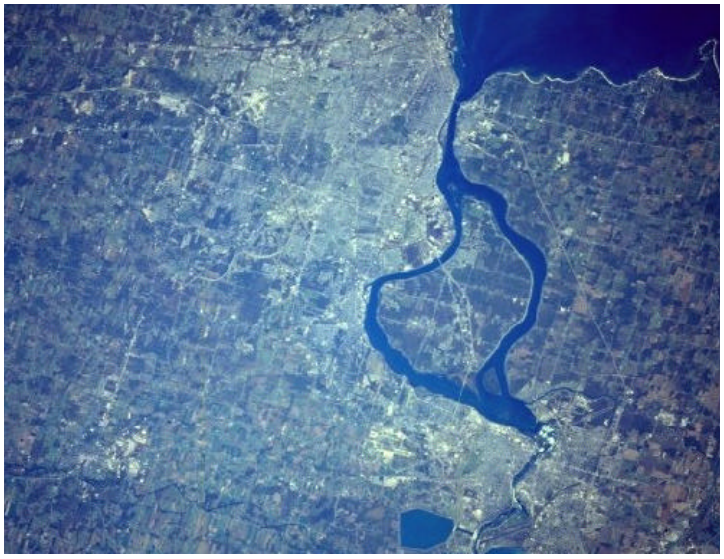
Read to partner	Answer
1. 41°N, 87°W	Chicago, Illinois
2. 42°N, 78°W	Buffalo, NY
3. 28°N, 80°W	Cape Canaveral, Florida
4. 34°N, 118°W	Los Angeles, California
5. 36°N, 86°W	Nashville, Tennessee
6. 21°N, 157°W	Honolulu, Hawaii
7. 30°N, 89°W	New Orleans, Louisiana
8. 29°N, 95°W	Houston, Texas
9. 38°N, 77°W	Washington, D.C.
10 36°N, 115°W	Las Vegas, Nevada

Longitudes and Latitudes are given in degrees only. These are not actual figures. For instance Las Vegas is actually 36 degrees 12 minutes North, 115 degrees 13 minutes west.

Activity #4

Location Is Everything

Step 1. Distribute a location description to each student. They will then find the latitude and longitude of the place described on their card and thus identify it.
activity. Have each student read the description -- but not the name -- on his or her card,



This picture of Buffalo, NY, was taken from the Space Shuttle (STS-68) on October 3, 1994.

This picture of Baghdad, Iraq, was taken from the Space Shuttle (STS-59) on March 13, 1994.

Step 2. After everyone has found their location, gather the class together for a large-group and the rest of the class locate it using the latitude/longitude that the student gives them. Then, as a class, determine if the location is correct.

Location Descriptions

1. The capital of Iraq with a population of almost 2 300 000 is located in central Iraq on the flood plains of the Tigris and Euphrates Rivers. It is the commercial and transportation center of the country. Major industries include the railroad, chemical refineries, and the making of carpets, leather, textiles, cement, and tobacco products. Agricultural fields which are irrigated by both the Tigris River and the Euphrates River surround the city.

The capital of Iraq is _____.
Its absolute location is _____, _____.-

---

2. The Niagara River forms part of the international boundary between the United States and Canada. Water exiting the eastern end of Lake Erie creates this north-flowing river, which empties into the southwestern part of Lake Ontario. The Niagara Falls were formed approximately 10 000 years ago.

What United States city shares the beautiful Niagara Falls sight?
Its absolute location is _____, _____.

---

3. This city located on the northern Illinois plain on the southwest shore of Lake Michigan covers an area in excess of 225 square miles and extends for more than 25 miles along the lakefront. The city is a major Great Lakes port, which provides the Mississippi River-Illinois River system access to the Saint Lawrence Seaway.

What United States city is on the southwest shore of Lake Michigan?
_____.
Its absolute location is _____, _____.

---

4. This metropolitan center is a leading banking, insurance city of the southwest. This Texas international airport is one of the largest commercial airports in the United States. This city is also known for being the place of President Kennedy's assassination.

What United States city is known for the assassination place of President Kennedy?
_____.
Its absolute location is _____, _____.

---

5. This city is an important center of world commerce. Located in the Far East, it covers 399 square miles. It lies in southeastern China on the Canton River. This city is a free port, a bustling trade,shipping, and banking center. Until recently it was governed by Great Britain.

What Chinese city is located in southeastern China on the Canton River?
_____. Its absolute location is _____,
_____.

6. This city is the largest in Texas. It is known for Johnson Space Center and the famous line "_____, we have a problem." It is located 50 miles from Galveston Island.

The name of this city is _____. I
ts absolute location is _____, _____.

---

7. This is the southernmost city in the continental United States. It is 4 miles long and 2 miles wide and located 60 miles from the southern tip of the mainland. It is part of the Florida Keys, which is a chain of small coral and limestone islands.

This southern most city in the continental United States is called _____.
Its absolute location is _____, _____.

---

8. This United States city is famous for its Central Park and New Year's Eve celebrations. The Statue of Liberty and the Empire State Building are found here.

This city known as the "Big Apple" is called _____.
Its absolute location is _____, _____.

---

9. This city in France is home to approximately 10 million people. It is known as the “City of Lights. The Seine River runs through this city. It is home to the Eiffel Tower.

This French city is _____ and its absolute location is
_____, _____.

---

10. This city in California has several features that make it a great place to take a vacation. Alcatraz Island is located here, as well as the Golden Gate Bridge. It is prone to earthquakes and has had many songs written about it. It is located in northern California.

This city in California is called _____and its absolute location is
_____, _____.

Discussion:
1. What is relative location? Give an example.
2. What is absolute location? Give an example.
3. What are latitude and longitude used for?
4. What might you find llatitude and longitude useful for?

Extensions:
1. List several famous places using latitude and longitude and have other students name the place.
2. Use the Web site HTTP://EARTH.JSC.NASA.GOV and locate several Earth observation photo-graphs using latitude and longitude. Use the technical search section.
3. Give the students an absolute location and have them give relative location directions.

Assessment:
Class participation and student sheets will be used for the assessment.

Topography

Objective:
Students will create a Geography Terms booklet and use those terms to identify Earth observation photographs of landforms.

National Standards:
· Geography
The World in Spatial Terms:
Analyze the spatial organization of people, places, and environments on the Earth's surface.
Use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
· Science
Earth and Space Science
Structure of the Earth system

Materials Needed:
Markers
Crayons
Colored Pencils
Pencils
Atlases
Encyclopedias
Student handouts
Dictionaries

Background
When astronauts are looking at the Earth from space ithey see many different land forms, such as moutains, plains, islands, and volcanoes. Scientists use Earth observation photographs to study how landforms change over time. These photos can show us everything from the growth of cities to the evaporation of water sources. By studying these photos scientists may be able to tell us what precautions we can take in order to not lose the environments we upon which we depend.

Topography Activity

1. This activity uses a variety of tools to help explain the terms associated with topography. The students will look up the definition of each word listed on the student handout and record their answers.
2. The students will compile a booklet with the terms they have learned. Items to be included in the booklet are the term's definition, a drawing of the term, examples of the term, and an Earth observation photographic example. The photographs have been included. (see Photo Match activity). Use atlases, encyclopedias, dictionaries, and Internet sites to complete this activity.

Possible Web sites:
http://eol.jsc.nasa.gov
http://earth.jsc.nasa.gov

Geography Definitions - Student Sheet

Provide a definition for each topographic term listed.

archipelago-

bay-

canal-

cape-

channel-

delta-

desert-

glacier-

gulf-

harbor-

island-

isthmus-

lake-

mountain-

Geography Definitions (page 2)

mountain range-

mouth(river)-

oasis-

peninsula-

plain-

river-

strait-

swamp-

tributary-

valley-

volcano-

Geography Definitions-Key

archipelago- a group of many islands

bay- a body of water partially enclosed by land but with a wide mouth allowing for ocean or sea access

canal- human-made waterway across land through which ships can pass through, or used for irrigation

cape- a point of land extending into a body of water

channel- a narrow, deep waterway connecting two bodies of water

delta- a deposit of sand and soil that collects at the mouth of a river which is often triangular, and therefore is named for the Greek letter Δ

desert- a dry, barren region of sand

glacier- a mass of ice that moves slowly down a mountain

gulf- part of an ocean extending into land

harbor- sheltered area of water where ships anchor

island- a small area of land completely surrounded by water

isthmus- narrow strip of land with water on both sides that connects two larger land masses

lake- a large inland body of water

mountain- a high-elevation landform

Geography Definitions-Key (page 2)

mountain range- a series of moutain similar moutain ridges

mouth (river)- the part of a river that flows into another body of water

oasis- a fertile place in the desert with water and vegetation

peninsula- land surrounded by water on all sides but one

plain- broad, flat land

river- a large stream of water that flows into a lake or ocean

strait- a narrow waterway that connects two bodies of water

swamp- low, wet land that supports grass and trees

tributary- a river that flows into a larger river

valley- low land between two hills or mountains

volcano- opening in the Earth's surface through which steam and lava are forced out

Give Me An Example - Student Sheet

Provide an example for each geography term listed.

archipelago-

bay-

canal-

cape-

channel-

delta-

desert-

glacier-

gulf-

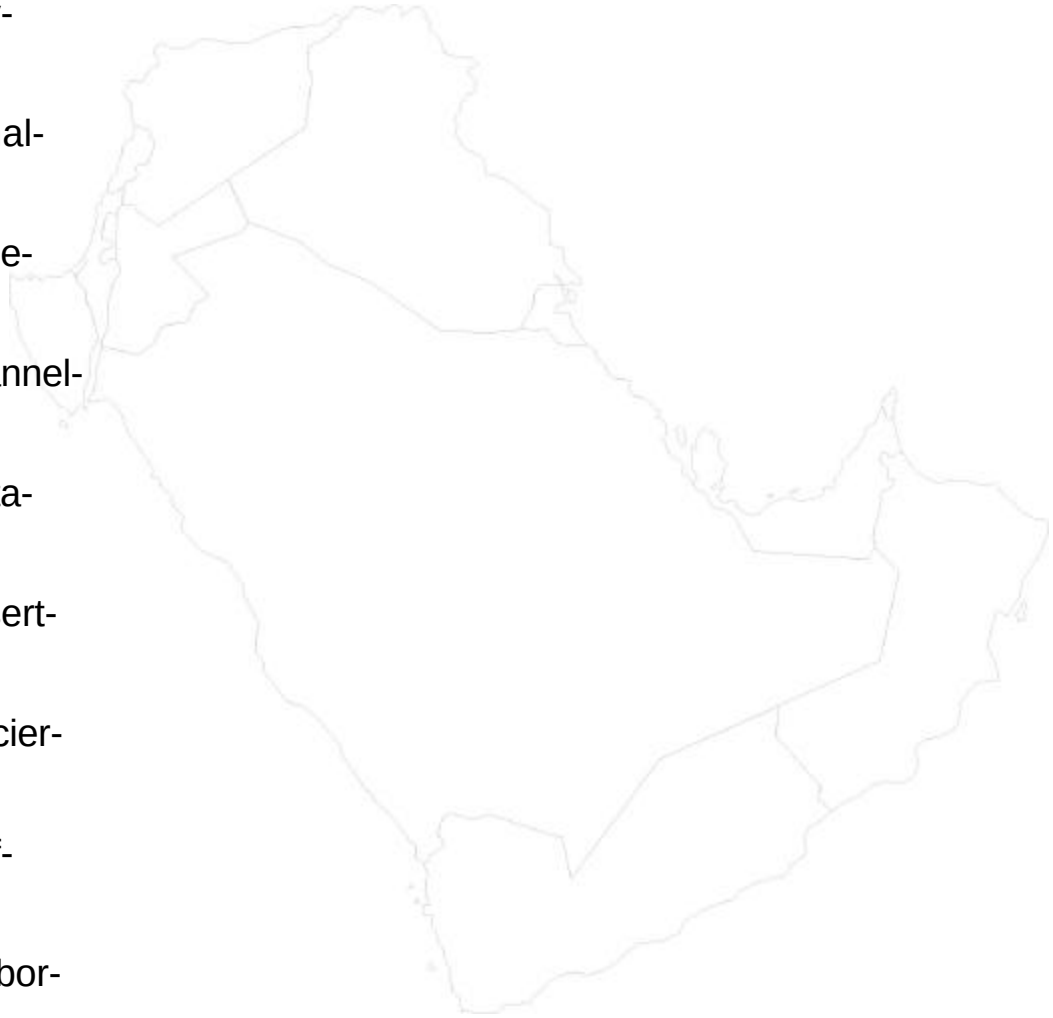
harbor-

island-

isthmus-

lake-

mountain-



Give Me An Example (page 2)

mountain range-

mouth (river)-

oasis-

peninsula-

plain-

river-

strait-

swamp-

tributary-

valley-

volcano-

Give Me An Example-Key

1. archipelago- Canary Islands, Hawaiian Islands, West Indies, Indonesia
2. bay- San Francisco Bay, Bay of Biscay, Bay of Bengal, Hudson Bay
3. canal- Erie, Panama, Suez
4. cape- Cape Canaveral, Cape Cod, Cape of Good Hope
5. channel- English Channel, Mozambique Channel
6. delta- Mississippi, Amazon, Nile
7. desert- Sahara, Gobi, Mojave
8. glacier locations- Glacier Bay in Alaska, Himalayas, Alps, Greenland
9. gulf- Gulf of Mexico, Persian Gulf
10. harbor- Pearl Harbor, Boston Harbor, Hong Kong
11. island- Long Island, Hawaiian Islands, Okinawa
12. isthmus- Panama
13. lake- Great Salt Lake, Great Lakes, Lake Chad
14. mountain- Pikes Peak, Mt. McKinley, Everest
15. mountain range- Rockies, Alps, Himalayas
16. mouth (river)- the opening of any river
17. oasis- [Look in the Sahara and Arabian Deserts]f
18. peninsula- Florida, Sinai
19. plain- Pampas, Great Plains
20. river- Nile, Amazon, Mississippi
21. strait- Strait of Gibraltar, Bering Strait, Florida
22. swamp- Everglades, Okefenokee
23. tributary- Missouri River for the Mississippi River
24. valley- Death Valley, Loire Valley

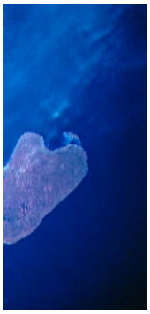
Show Me!

Match the definition with the photographic example.
Use these photos as illustrations of the topographic terms in your booklet.

1. archipelago
2. bay
3. canal
4. cape
5. channel
6. delta
7. desert
8. glacier
9. gulf
10. harbor
11. island
12. isthmus
13. lake
14. mountain
15. mountain range
16. mouth(river)
17. oasis
18. peninsula
19. plain
20. river
21. strait
22. swamp
23. tributary
24. valley
25. volcano

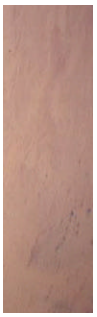
A

B

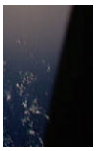


C

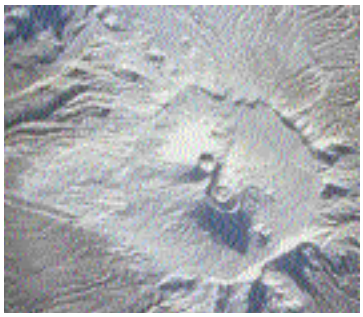
D



E



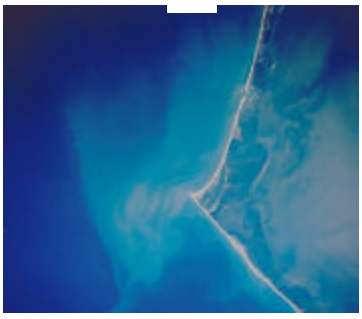
F



G

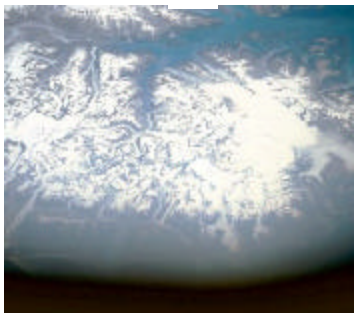
H

I



J

K

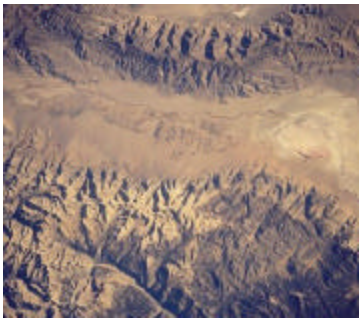


L

M

N

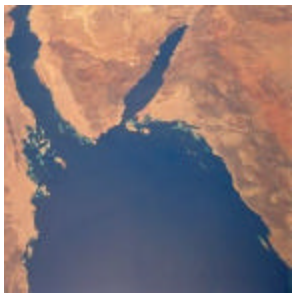
O



P

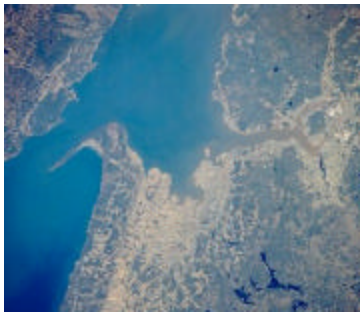
Q

R



S

T

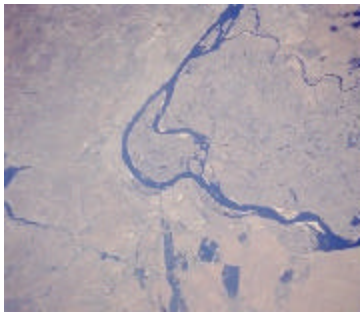


U

V

W

X



Y

Match the topogrpahic term to the Earth observation photographic will illustrates it, by writing the name of the land or water feature next to the corresponding letter.

A _____

B _____

C _____

D _____

E _____

F _____

G _____

H _____

I _____

J _____

K _____

L _____

M _____

N _____

O _____

P _____

Q _____

R _____

S _____

T _____

U _____

V _____

W _____

X _____

Y _____

Photo Match Key

A	1	B	12
C	11	D	15
E	17	F	18
G	25	H	2
I	14	J	4
K	7	L	8
M	16	N	20
O	22	P	24
Q	6	R	3
S	9	T	21
U	5	V	19
W	13	X	10
Y	23		

Extensions:

1. Students should write a sentence using each one of the topography terms, and draw a pictures of the features the term decribes.
2. Students may work in small groups to develop and design a travel brochure using one of the geographic terms.
3. Have students take photographs of different landforms or bring in pictures they already have at home to share. This makes a good field trip.

Assessment:
All classroom work as well as group activities may be used for assessment.